How to create a **Devcontainer** for your Python project 🐳

Jeroen Overschie

Machine Learning Engineer

GoDataDriven

The use case

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So we need to align on:

- 📌 A specific Java version
- 📌 A specific Python version
- 📌 A specific `pyspark` version

→ otherwise we do not enjoy the guarantees we want in **production** code

PP

Petra the Python Dev

Hi my venv somehow got corrupted 🥲 . It's saying `No module named 'numpy'` even though I seemingly have it installed. Not sure how to fix.
P.S. this is also why I was not in the meeting.

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I'm trying to dockerize the project but it's haaard. Everything that works on my Windows laptop seems to fail on Linux.

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JJ **Johnny Junior**
Hii. Can you maybe run `pip show pyspark`? I'm curious which pyspark version you are running 🧐. Because if it works for you but not for me and also not in the CI maybe your environment is different than both. Just checking.

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JJ **Johnny Junior**
Good day. I'm new at the company and wanted to get started working on the repo. Tried following the README steps but doesn't work. By any chance: are there any more detailed docs available for project setup? No right? 🙃

🐛 Issues

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PP Petra the Python Dev

Corrupted Virtual Environment

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🔄 How to get a **reproducible** Dev environment?

Devcontainers to the rescue ⛑️!

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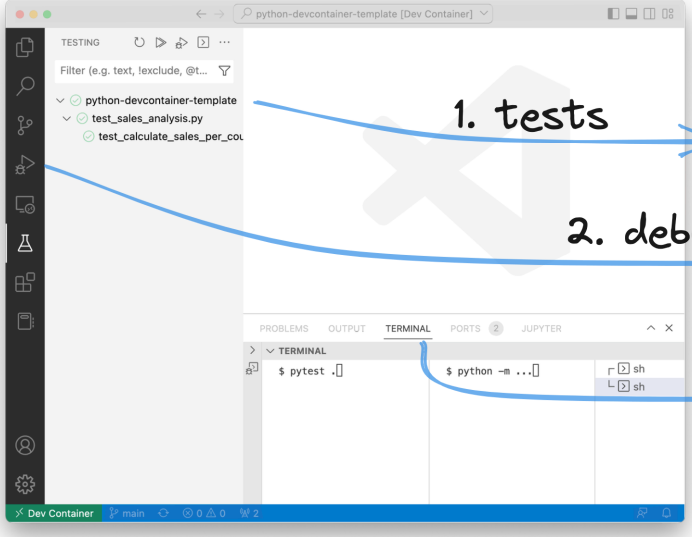
🐳 **Docker** helps us create a formal definition of our environment.

🔌 **Devcontainers** allow you to connect your editor (IDE) to that container.

Develop in your IDE,
but run ...



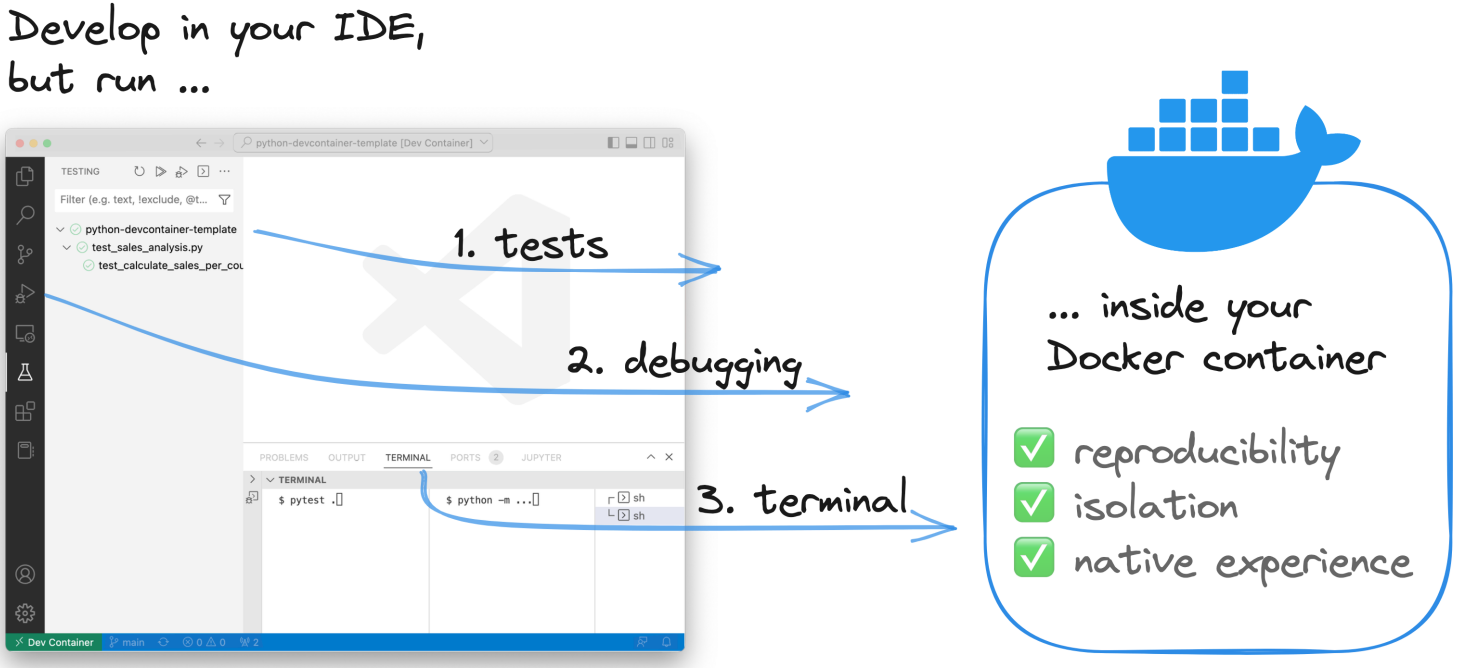
1. tests

2. debugging

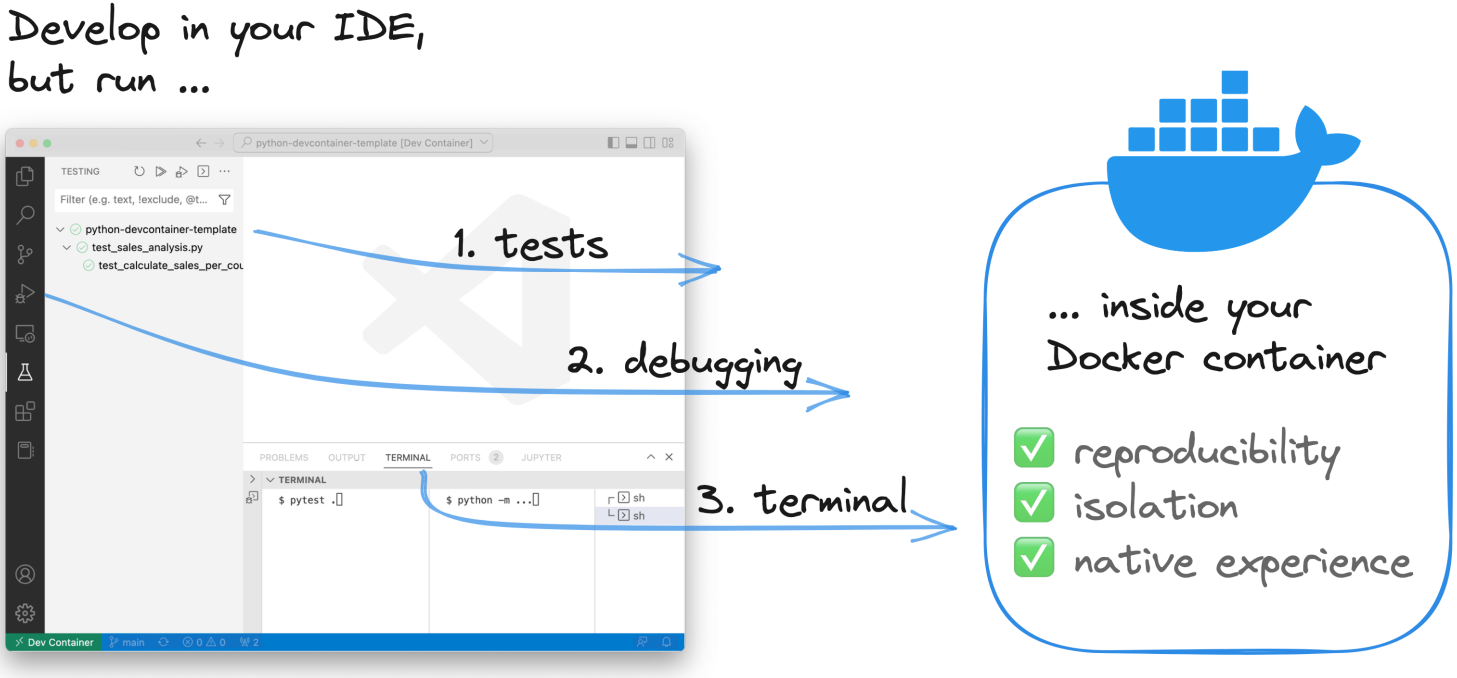
3. terminal

... inside your
Docker container

- ✅ reproducibility
- ✅ isolation
- ✅ native experience

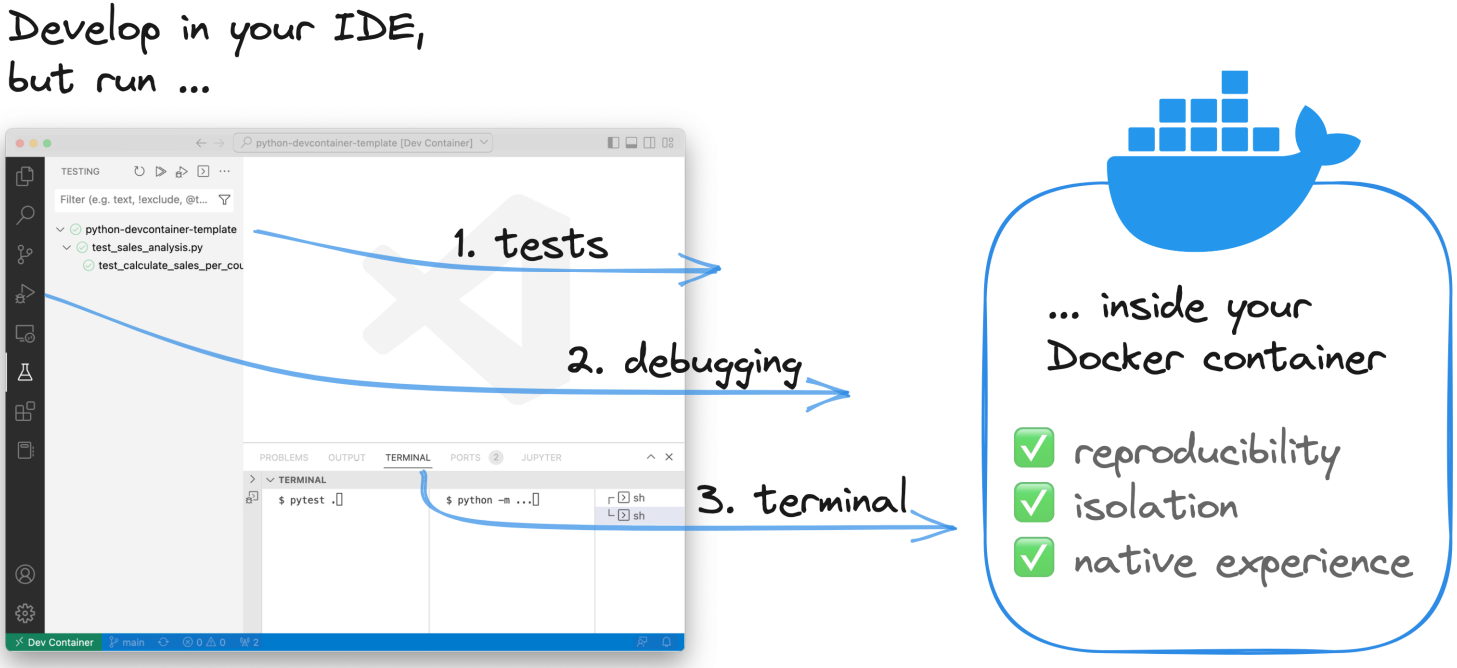


🔄 **Reproducible** means:



🔄 **Reproducible** means:

- ⚡ Faster onboarding



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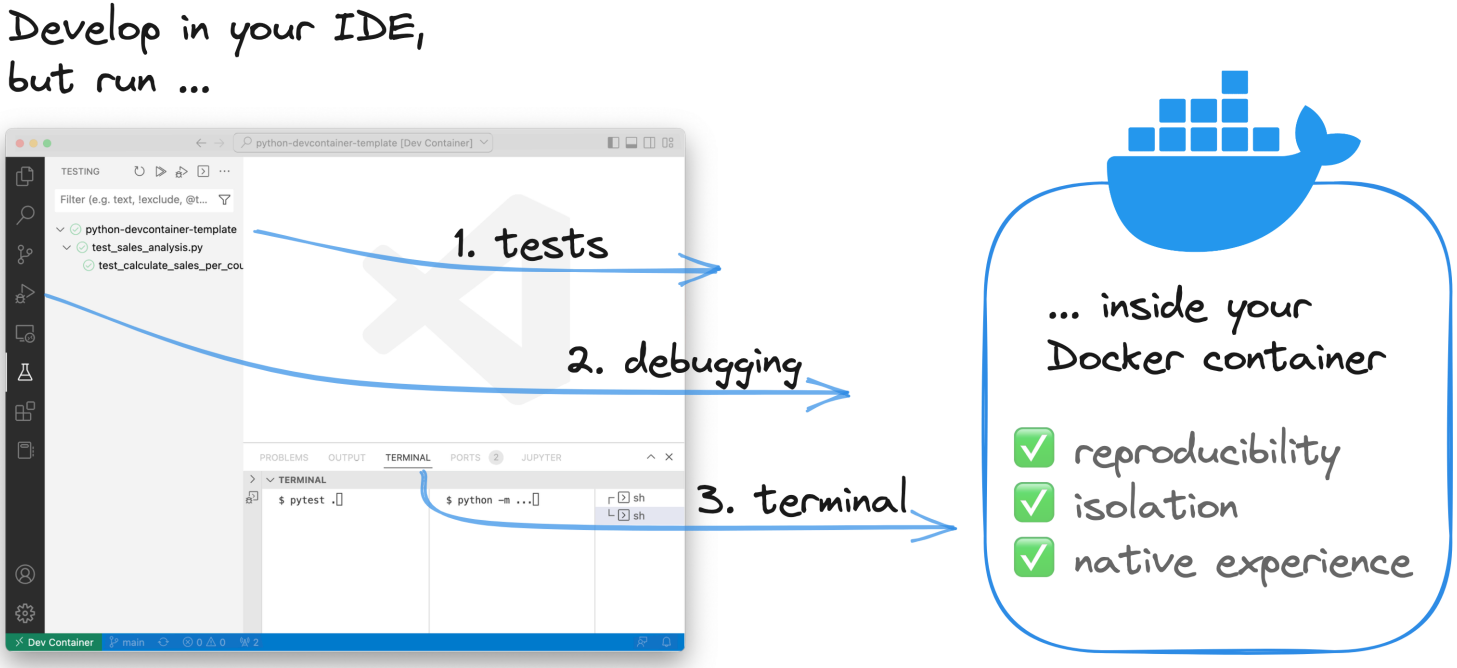

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- ⏱️ Smaller gap to production

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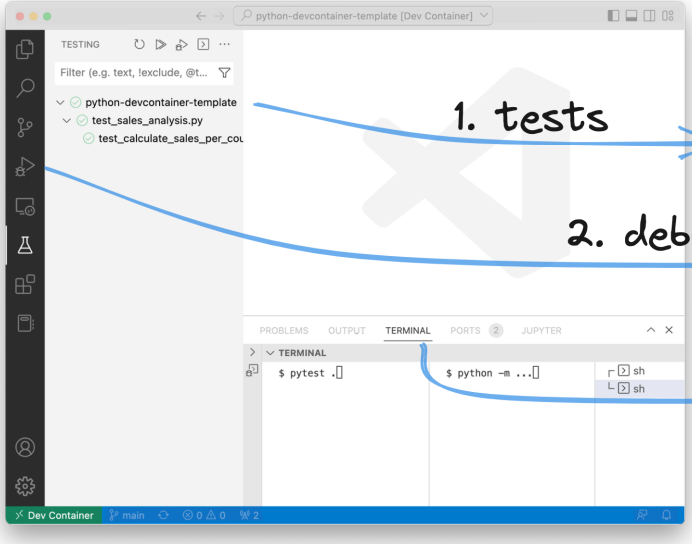

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Downsides?

- Docker knowledge

👷🏻 Let’s build a Devcontainer!

Let’s say we have a really simple project that looks like this:

```
$ tree .
.
├── README.md
├── requirements.txt
├── requirements-dev.txt
├── sales_analysis.py
└── test_sales_analysis.py
```

The `.devcontainer` folder

Your Devcontainer spec will live inside the `.devcontainer` folder.

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There will be two main files:

- `devcontainer.json`
- `Dockerfile`

Create a new file called `devcontainer.json`:

```
{
    "build": {
        "dockerfile": "Dockerfile",
        "context": ".."
    }
}
```

So how does this `Dockerfile` look like?

```
FROM python:3.10

# Install Java
RUN apt update && \
    apt install -y sudo && \
    sudo apt install default-jdk -y

## Pip dependencies
# Upgrade pip
RUN pip install --upgrade pip
# Install production dependencies
COPY requirements.txt /tmp/requirements.txt
RUN pip install -r /tmp/requirements.txt && \
    rm /tmp/requirements.txt
# Install development dependencies
COPY requirements-dev.txt /tmp/requirements-dev.txt
RUN pip install -r /tmp/requirements-dev.txt && \
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RUN pip install -r /tmp/requirements-dev.txt && \
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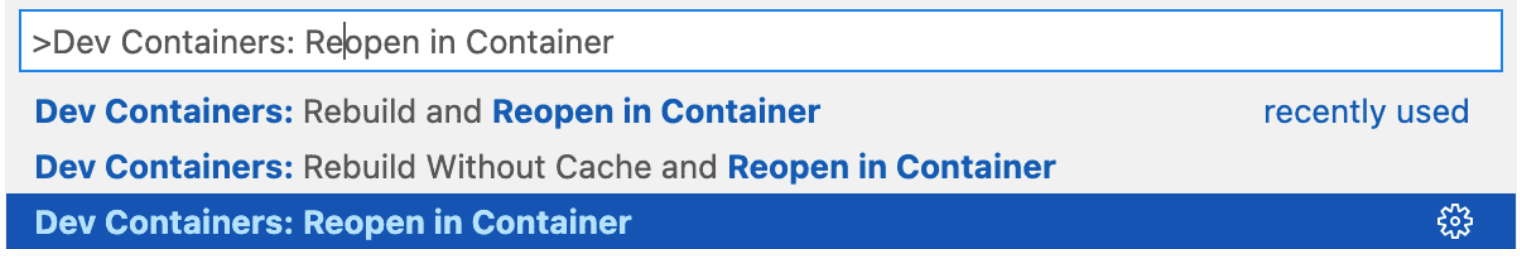
```

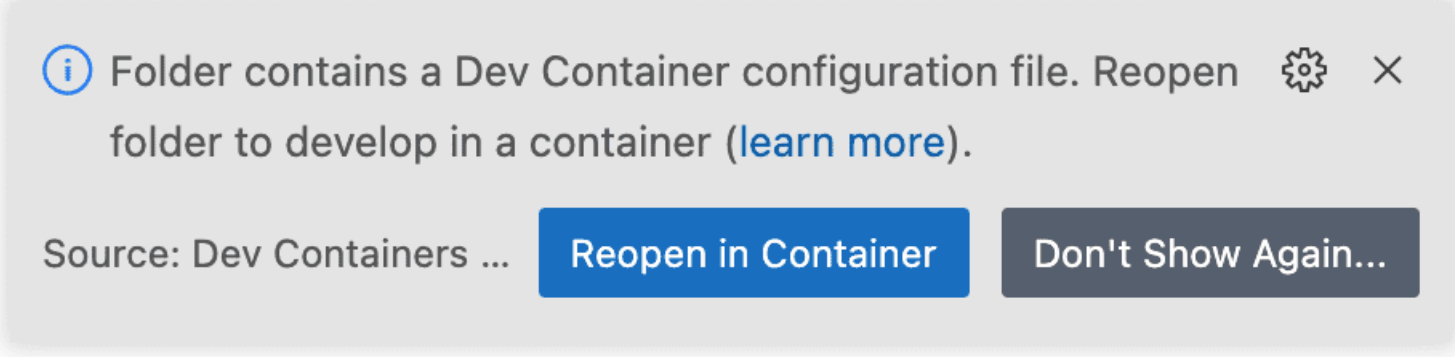
Opening the Devcontainer

The `.devcontainer` folder in place, now it's time to open our Devcontainer.

Open up the command pallete (`CMD` + `Shift` + `P`) and select "*Dev Containers: Reopen in Container*":



Upon opening a repo with a valid `.devcontainer` folder, you are already notified:



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python-devcontainer-template [Dev Container]

EXPLORER

OPEN EDITORS

Get Started

PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

Get Started

Start

New File...

Open...

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fseval [SSH: 108.142.194.191] ~

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Walkthroughs

Learn the Fundamentals

Jump right into VS Code and get an overview of the must-have features.

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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL

Starting Dev Container (show log)

OUTLINE

TIMELINE

Opening Remote... 0 0 0

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TERMINAL Dev Containers

```
[+] Building 7.9s (4/8)
 => [internal] load .dockerignore                                                    0.0s
 => => transferring context: 2B                                                      0.0s
 => [internal] load metadata for mcr.microsoft.com/devcontainers/base:0-alpine-3.1  1.5s
 => [1/4] FROM mcr.microsoft.com/devcontainers/base:0-alpine-3.16@sha256:591c06ef1  6.3s
 => => resolve mcr.microsoft.com/devcontainers/base:0-alpine-3.16@sha256:591c06ef1  0.0s
 => => sha256:591c06ef1863bb36c793adbea93e74d3c577c391ca9bc43746c3c841 743B / 743B  0.0s
 => => sha256:ad04942bd3e90a22cbefe2e5d416ba64a16a37f26d0ba019da26 1.16kB / 1.16kB  0.0s
 => => sha256:a3bd09c7d43cbb02c00710882c9bada6e114d691ae34ad692a31 4.96kB / 4.96kB  0.0s
 => => sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c 2.71MB / 2.71MB  1.0s
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 32.51MB / 45.22MB  6.3s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46
 => [internal] load build c
 => => transferring context
```

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```
[+] Building 15.0s (5/8)
 => => sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c 2.71MB / 2.71MB  1.0s
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
 => => extracting sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d6  0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context: 2.16MB                                                 0.0s
 => [2/4] RUN apk add --no-cache  nodejs  python3  npm  make  g++  docker-cli  doc  3.9s
 => => # fetch https://dl-cdn.alpinelinux.org/alpine/v3.16/main/aarch64/APKINDEX.tar.gz
 => => # fetch https://dl-cdn.alpinelinux.org/alpine/v3.16/community/aarch64/APKINDEX.ta
 => => # r.gz
 => => # (1/24) Upgrading m
 => => # (2/24) Installing
```

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```
[+] Building 21.6s (5/8)
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
 => => extracting sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d6  0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context: 2.16MB                                                 0.0s
 => [2/4] RUN apk add --no-cache  nodejs  python3  npm  make  g++  docker-cli  do  10.5s
 => => # (2/24) Installing docker-cli (20.10.20-r0)
 => => # (3/24) Installing docker-cli-buildx (0.8.2-r6)
 => => # (4/24) Installing docker-cli-compose (2.12.2-r0)
 => => # (5/24) Installing
 => => # (6/24) Installing
 => => # (7/24) Installing
```

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```
[+] Building 28.5s (5/8)
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
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 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
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 => [internal] load build context                                                   0.0s
 => => transferring context: 2.16MB                                                 0.0s
 => [2/4] RUN apk add --no-cache  nodejs  python3  npm  make  g++  docker-cli  do  17.4s
 => => # (9/24) Installing mpfr4 (4.1.0-r0)
 => => # (10/24) Installing mpc1 (1.2.1-r0)
 => => # (11/24) Installing gcc (11.2.1_git20220219-r2)
 => => # (12/24) Installing
 => => # (13/24) Installing
 => => # (14/24) Installing
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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL Dev Containers

```
[+] Building 35.4s (5/8)
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
 => => extracting sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d6  0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context: 2.16MB                                                 0.0s
 => [2/4] RUN apk add --no-cache  nodejs  python3  npm  make  g++  docker-cli  do  24.2s
 => => # (21/24) Installing mpdecimal (2.5.1-r1)
 => => # (22/24) Installing python3 (3.10.8-r0)
 => => # (23/24) Installing gcc-zsh-completion (5.8.1-r4)
 => => # (24/24) Installing
 => => # Executing busybox-
 => => # OK: 513 MiB in 140
```

Starting Dev Container (show log)

Opening Remote... 0 0 0

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python-devcontainer-template [Dev Container]

EXPLORER

OPEN EDITORS

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PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

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python-devcontainer-template__slides ..

mcp_ui_example /Users/dunnkers/git

fseval [SSH: 108.142.194.191] ~

degiro-automated-trading [Dev Contai...

python-devcontainer-template [Dev C...

More...

Walkthroughs

Learn the Fundamentals
Jump right into VS Code and get an overview of the must-have features.

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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL Dev Containers

```
[+] Building 37.9s (6/8)
 => => resolve mcr.microsoft.com/devcontainers/base:0-alpine-3.16@sha256:591c06ef1  0.0s
 => => sha256:591c06ef1863bb36c793adbea93e74d3c577c391ca9bc43746c3c841 743B / 743B  0.0s
 => => sha256:ad04942bd3e90a22cbefe2e5d416ba64a16a37f26d0ba019da26 1.16kB / 1.16kB  0.0s
 => => sha256:a3bd09c7d43cbb02c00710882c9bada6e114d691ae34ad692a31 4.96kB / 4.96kB  0.0s
 => => sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c 2.71MB / 2.71MB  1.0s
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
 => => extracting sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d6  0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context
 => [2/4] RUN apk add --no-
 => [3/4] RUN cd && npm i r
```

Starting Dev Container (show log)

Opening Remote... 0 0 0

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python-devcontainer-template [Dev Container]

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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL

Dev Containers

```
[+] Building 39.2s (8/9)
 => => sha256:a3bd09c7d43cbb02c00710882c9bada6e114d691ae34ad692a31 4.96kB / 4.96kB  0.0s
 => => sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c 2.71MB / 2.71MB  1.0s
 => => sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384 4.44kB / 4.44kB  0.3s
 => => sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325 45.22MB / 45.22MB  8.7s
 => => sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d 414B / 414B  0.5s
 => => extracting sha256:6875df1f535433e5affe18ecfde9acb7950ab5f76887980ff06c5cdd4  0.1s
 => => extracting sha256:46c8a4c701763665c0f6a96dad465e055caa1d9b0fd71ec82384a36c6  0.0s
 => => extracting sha256:89acc97f9d32f668e8a644e85c3957f7973b7ce2e662db7325ec34fdd  0.8s
 => => extracting sha256:56d8df5ce3ee527967de511f9fef5835626ab84415196d14a3e2bf6d6  0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context: 2.16MB                                                 0.0s
 => [2/4] RUN apk add --no-cache  nodejs  python3  npm  make  g++  docker-cli  do  24.4s
 => [3/4] RUN cd && npm i node-pty                                                  3.3s
 => [4/4] COPY .vscode-remo
 => exporting to image
 => => exporting layers
```

Starting Dev Container (show log)

Opening Remote... 0 0 0

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python-devcontainer-template [Dev Container]

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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL

Dev Containers

```
ume,source=vscode,target=/vscode,external=true --skip-post-create --update-remote-user-ui
d-default off --mount-workspace-git-root true --terminal-columns 89 --terminal-rows 18
[41958 ms] (node:126) [DEP0005] DeprecationWarning: Buffer() is deprecated due to securit
y and usability issues. Please use the Buffer.alloc(), Buffer.allocUnsafe(), or Buffer.fr
om() methods instead.
[41958 ms] (Use `node --trace-deprecation ...` to show where the warning was created)
[41960 ms] @devcontainers/cli 0.23.2. Node.js v16.17.1. linux 5.15.49-linuxkit arm64.
[41960 ms] Start: Run: docker buildx version
[42028 ms] github.com/docker/buildx v0.8.2 6224def4dd2c3d347eee19db595348c50d7cb491
[42029 ms]
[42029 ms] Start: Resolving Remote
[42031 ms] Start: Run: git rev-parse --show-cdup
[42035 ms] Start: Run: docker ps -q -a --filter label=vsch.local.repository=https://githu
b.com/godatadriven/python-devcontainer-template --filter label=vsch.local.repository.volu
me=python-devcontainer-temp
l.repository.folder=python-
[42063 ms] Start: Run: dock
```

Starting Dev Container (show log): Cloning Repository

Opening Remote... 0 0 0

File Edit Selection View Go Terminal Window Help

python-devcontainer-template [Dev Container]

EXPLORER

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PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

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PROBLEMS OUTPUT TERMINAL PORTS

TERMINAL

Dev Containers

```
[46744 ms] aarch64
[46744 ms]
[46744 ms] Start: Run in container: (cat /etc/os-release || cat /usr/lib/os-release) 2>/dev/null
[46746 ms] PRETTY_NAME="Debian GNU/Linux 11 (bullseye)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/support"
BUG_REPORT_URL="https://bugs.debian.org/"
[46746 ms]
[46746 ms] Start: Run in co
[46748 ms] Start: Run in co
[46749 ms] Start: Run in co
```

Starting Dev Container (show log): Cloning Repository

OUTLINE

TIMELINE

Opening Remote... 0 0 0

File Edit View Go Window Help

python-devcontainer-template [Dev Container]

EXPLORER

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PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

- .devcontainer
- .github
- .gitignore
- LICENSE
- README.md
- requirements-dev.txt
- requirements.txt
- sales_analysis.py
- test_sales_analysis.py

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Clone Git Repository...

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python-devcontainer-template__slides ..

mcp_ui_example /Users/dunnkers/git

fseval [SSH: 108.142.194.191] ~

degiro-automated-trading [Dev Contai...

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PROBLEMS OUTPUT TERMINAL PORTS 1

DEBUG CONSOLE

TERMINAL

```
onnection established
[47477 ms] [10:24:52] [127.0.0.1][a0fe6473][ExtensionHostC
onnection] New connection established.
[47494 ms] [10:24:52] [127.0.0.1][a0fe6473][ExtensionHostC
onnection] <267> Launched Extension Host Process.
[48057 ms] Installing extension 'ms-python.python'...
[10:24:53] Getting Manifest... ms-python.python
[48113 ms] [10:24:53] Installing extension: ms-python.pyth
on
[49049 ms] [10:24:54] Getting Manifest... ms-toolsai.jupyt
er
[49393 ms] [10:24:54] Getting Manifest... ms-toolsai.jupyt
er-keymap
[49439 ms] [10:24:54] Getting Manifest... ms-toolsai.jupyt
er-renderers
[49528 ms] [10:24:54] Getting Manifest... ms-toolsai.vscod
e-jupyter-cell-tags
```

Dev Container main 1↓ 0↑ 0 0 1

File Edit View Go Window Help

python-devcontainer-template [Dev Container]

EXPLORER

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PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

- .devcontainer
- .github
- .gitignore
- LICENSE
- README.md
- requirements-dev.txt
- requirements.txt
- sales_analysis.py
- test_sales_analysis.py

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Clone Git Repository...

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python-devcontainer-template__slides ..

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fseval [SSH: 108.142.194.191] ~

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PROBLEMS OUTPUT TERMINAL PORTS 1

DEBUG CONSOLE

TERMINAL

```
ee5900: ms-toolsai.vscode-jupyter-slideshow
[49950 ms] [10:24:55] Renamed to /home/nonroot/.vscode-ser
ver/extensions/ms-toolsai.vscode-jupyter-slideshow-0.1.5
[49953 ms] [10:24:55] Extracting completed. ms-toolsai.vsc
ode-jupyter-slideshow
[49961 ms] [10:24:55] Extracted extension to /home/nonroot
/.vscode-server/extensions/.552d0cb0-2d01-4114-8f17-e82825
8352b5: ms-toolsai.vscode-jupyter-cell-tags
[49966 ms] [10:24:55] Renamed to /home/nonroot/.vscode-ser
ver/extensions/ms-toolsai.vscode-jupyter-cell-tags-0.1.6
[49969 ms] [10:24:55] Extracting completed. ms-toolsai.vsc
ode-jupyter-cell-tags
[50352 ms] [10:24:55] Extracted extension to /home/nonroot
/.vscode-server/extensions/.f2ce7f42-72e6-4fa1-8fee-045e4e
f1e5a9: ms-toolsai.jupyter-renderers
[50355 ms] [10:24:55] Renamed to /home/nonroot/.vscode-ser
ver/extensions/ms-toolsai.jupyter-renderers-1.0.12
```

Dev Container main 1↓ 0↑ 0 0 1

File Edit Selection View Go Run Terminal Window Help

python-devcontainer-template [Dev Container]

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python-devcontainer-template__slides ..

mcp_ui_example /Users/dunnkers/git

fseval [SSH: 108.142.194.191] ~

degiro-automated-trading [Dev Contai...

python-devcontainer-template [Dev C...

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More...

PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL Dev Containers

```
cessfully installed.
[61626 ms] Port forwarding connection from 52216 > 44995 >
 44995 in the container.
[61627 ms] Start: Run in container: /home/nonroot/.vscode-
server/bin/6261075646f055b99068d3688932416f2346dd3b/node -
e
[61628 ms] Port forwarding connection from 52217 > 44995 >
 44995 in the container.
[61628 ms] Start: Run in container: /home/nonroot/.vscode-
server/bin/6261075646f055b99068d3688932416f2346dd3b/node -
e
[61756 ms] Port forwarding 52217 > 44995 > 44995 stderr: C
onnection established
[61783 ms] Port forwarding 52216 > 44995 > 44995 stderr: C
onnection established
[66770 ms] Port forwarding 52217 > 44995 > 44995 stderr: R
emote close
```

Dev Container main 2↓ 0↑ 0 0 2

File Edit Selection View Go Run Terminal Window Help

python-devcontainer-template [Dev Container]

EXPLORER

OPEN EDITORS

Get Started

PYTHON-DEVCONTAINER-TEMPLATE [DEV CONT...

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Clone Git Repository...

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fseval [SSH: 108.142.194.191] ~

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PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL

```
$
```

Dev Cont...

sh

Dev Container main 2↓ 0↑ 0 0 2

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python-devcontainer-template [Dev Container]

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PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL

```
$ cat /etc/os-release
PRETTY_NAME="Debian GNU/Linux 11 (bullseye
)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/suppor
t"
BUG_REPORT_URL="https://bugs.debian.org/"
$
```

Dev Cont...

sh

Dev Container main 2↓ 0↑ 0 0 2

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python-devcontainer-template [Dev Container]

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PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL

```
$ cat /etc/os-release
PRETTY_NAME="Debian GNU/Linux 11 (bullseye
)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/suppor
t"
BUG_REPORT_URL="https://bugs.debian.org/"
$ java -version
```

Dev Cont...

sh

Dev Container main 2↓ 0↑ 0 0 2

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python-devcontainer-template [Dev Container]

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PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL

```
PRETTY_NAME="Debian GNU/Linux 11 (bullseye
)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/suppor
t"
BUG_REPORT_URL="https://bugs.debian.org/"
$ java -version
openjdk version "11.0.16" 2022-07-19
OpenJDK Runtime Environment (build 11.0.16
+8-post-Debian-1deb11u1)
OpenJDK 64-Bit Server VM (build 11.0.16+8-
post-Debian-1deb11u1, mixed mode)
$
```

Dev Cont...

sh

Dev Container main 2↓ 0↑ 0 0 2

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python-devcontainer-template [Dev Container]

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fseval [SSH: 108.142.194.191] ~

degiro-automated-trading [Dev Contai...

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Get started wi... Updated

More...

PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG CONSOLE

TERMINAL

```
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/suppor
t"
BUG_REPORT_URL="https://bugs.debian.org/"
$ java -version
openjdk version "11.0.16" 2022-07-19
OpenJDK Runtime Environment (build 11.0.16
+8-post-Debian-1deb11u1)
OpenJDK 64-Bit Server VM (build 11.0.16+8-
post-Debian-1deb11u1, mixed mode)
$ python --version
Python 3.10.8
$
```

Dev Cont...

sh

Dev Container main 2↓ 0↑ 0 0 2

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python-devcontainer-template [Dev Container]

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fseval [SSH: 108.142.194.191] ~

degiro-automated-trading [Dev Contai...

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Get started wi... Updated

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PROBLEMS OUTPUT TERMINAL PORTS 2 JUPYTER

DEBUG C... Filter (e.g. ...

TERMINAL

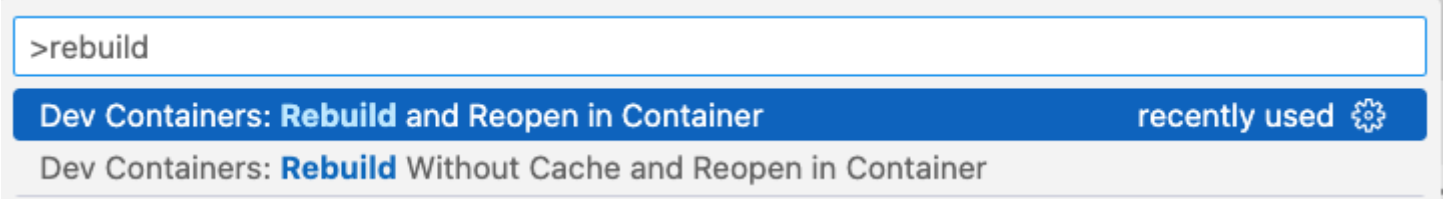
```
BUG_REPORT_URL="https://bugs.debian.org/"
$ java -version
openjdk version "11.0.16" 2022-07-19
OpenJDK Runtime Environment (build 11.0.16
+8-post-Debian-1deb11u1)
OpenJDK 64-Bit Server VM (build 11.0.16+8-
post-Debian-1deb11u1, mixed mode)
$ python --version
Python 3.10.8
$ python
Python 3.10.8 (main, Nov 15 2022, 09:21:17
) [GCC 10.2.1 20210110] on linux
Type "help", "copyright", "credits" or "li
cense" for more information.
>>> import pyspark
>>> pyspark.__version__
'3.3.1'
>>>
```

Dev Cont...

python

Dev Container main 2↓ 0↑ 0 0 2

Rebuilding allows you to get a fresh environment anytime you want:



What is happening under the hood 🚗

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   VSCode Server is installed as a service in the container itself so your VSCode installation can communicate with the container.

   For example, install and run **extensions**.

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   Config like `~/.gitconfig` and `~/.ssh/known_hosts` are copied over to their respective locations in the container.

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2. **Config is copied** over.

   Config like `~/.gitconfig` and `~/.ssh/known_hosts` are copied over to their respective locations in the container.

3. **Filesystem mounts**.

   VSCode automatically takes care of mounting:

   - The folder you are running the Devcontainer from.
   - Your VSCode workspace folder.

Opening your Devcontainer with the click of a button

Your entire project setup is now encapsulated in the Devcontainer. So actually we can add a **Markdown** button to open up the Devcontainer:

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```markdown
[
    ![Open in Remote - Containers](
        https://img.shields.io/static/v1?label=Remote%20-%20Containers&message=Open&color=blue&logo=visualstudioco
    )
](
    https://vscode.dev/redirect?url=vscode://ms-vscode-remote.remote-containers/cloneInVolume?url=https://github.com/godatadriven/python-devcontainer-template
)
```

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)
```

Which basically means, open this URL:

```
vscode://
  ms-vscode-remote.remote-containers/
  cloneInVolume?
  url=https://github.com/godatadriven/python-devcontainer-template
```

Just modify the GitHub URL after `url=` ✓.

This renders the following button:

What kind of README would you rather like?

49 lines (29 sloc) | 932 Bytes Raw Blame

Your fantastic repo

Hi! Welcome to the team ! Let's get you started quickly. This is what you have to do.

Installation

1. Install Java 11.0.16
2. Install Python 3.10.8

Virtual environment

There are a couple ways to go about this.

1. `pyenv`

   First, install pyenv using the pyenv-installer.

   Then, create a new environment using:

   ```
   pyenv shell 3.10.8
   pyenv virtualenv my-venv
   pyenv shell my-venv
   ```

2. Conda

   Install conda and create a virtualenv.

3. Python venv

   ```
   python -m venv venv
   source ./venv/bin/activate
   ```

pip packages

1. Make sure to `pip` install the following packages:
   - black
   - pytest
   - jupyter (not necessary when installing for CI or prod)
   - mypy

⚠️ Note: this is entire setup is known to work for Debian GNU/Linux 11 (bullseye), not tested for other Operating Systems.

15 lines (8 sloc) | 1 KB Raw Blame

Your fantastic repo

If you happen to use VSCode as your editor, you can open the repo in a **Devcontainer**. Devcontainers allow you to develop *inside* a Docker container - which means all dependencies and packages are automatically set up for you. First, make sure you have the Remote Development extension installed.

Then, you can do two things.

1. Click the following button:

   Remote - Containers | Open

2. Or, open up the repo in VSCode. Then, you should see the following notification:

   Folder contains a Dev Container configuration file. Reopen folder to develop in a container (learn more).

   Source: Dev Containers ... | Reopen in Container | Don't Show Again...

That's it 🙌 Enjoy developing.

Extending the Devcontainer

We have built a working Devcontainer, that is great! But a couple things are still missing.

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- Be able to access Spark UI (**opening up port 4040**)
- Run **Continuous Integration** (CI) in the Devcontainer

Let's see how.

Installing a non-root user

If you `pip install` a new package, you will see the following message:

```
WARNING: Running pip as the 'root' user can result in broken permissions and conflict
ing behaviour with the system package manager. It is recommended to use a virtual env
ironment instead: https://pip.pypa.io/warnings/venv
```

So let's go ahead and create a user for this scenario.

```
# Add non-root user
ARG USERNAME=nonroot
RUN groupadd --gid 1000 $USERNAME && \
    useradd --uid 1000 --gid 1000 -m $USERNAME
## Make sure to reflect new user in PATH
ENV PATH="/home/${USERNAME}/.local/bin:${PATH}"
USER $USERNAME
```

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```

Add the following property to `devcontainer.json`:

```
"remoteUser": "nonroot"
```

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```

Add the following property to `devcontainer.json`:

```
"remoteUser": "nonroot"
```

That's great! When we now start the container we should connect as the user `nonroot`.

Passing custom VSCode settings

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```
"customizations": {
    "vscode": {
        "extensions": [
            "ms-python.python"
        ],
        "settings": {
            "python.testing.pytestArgs": [
                "."
            ],
            "python.testing.unittestEnabled": false,
            "python.testing.pytestEnabled": true,
            "python.formatting.provider": "black",
            "python.linting.mypyEnabled": true,
            "python.linting.enabled": true
        }
    }
}
```

Accessing Spark UI

Since we are using pyspark, it would be nice to be able to access **Spark UI**.

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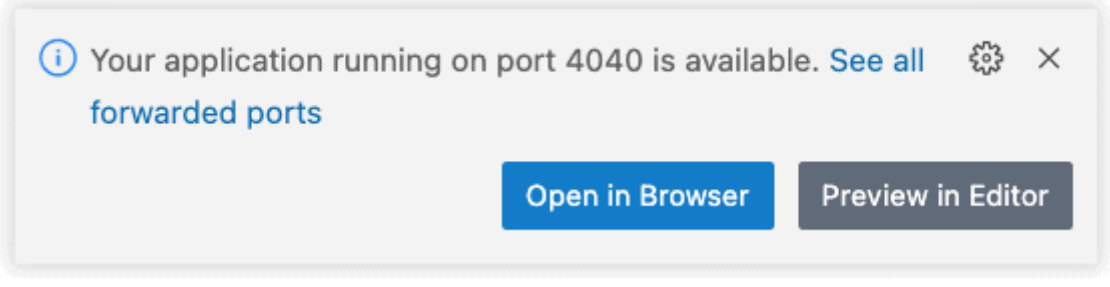
Since we are using pyspark, it would be nice to be able to access **Spark UI**.

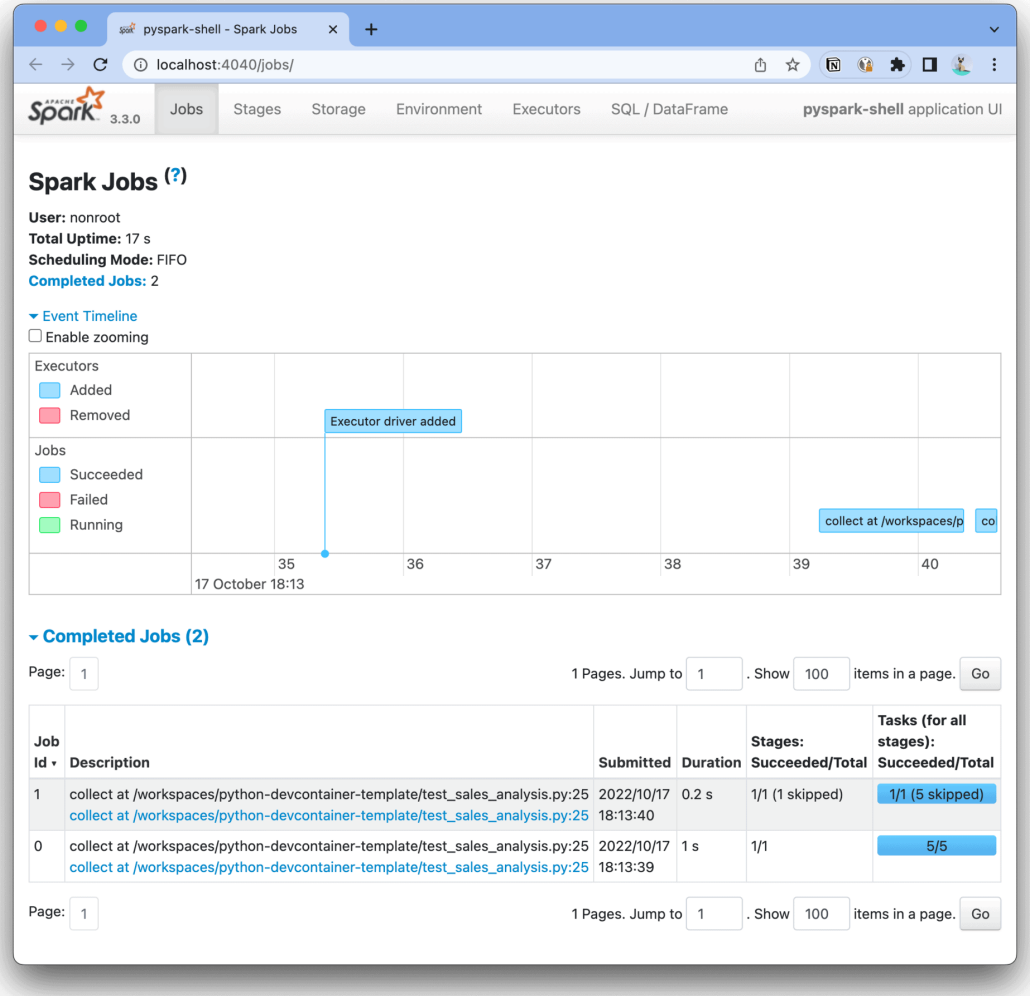
```
"portsAttributes": {
    "4040": {
        "label": "SparkUI",
        "onAutoForward": "notify"
    }
},

"forwardPorts": [
    4040
]
```

When we now run our code, we get a notification we can open Spark UI in the browser:



Resulting in the Spark UI like we know it:



Running our CI in the Devcontainer

Running our CI in the Devcontainer

There are two basic options:

1. Build the Docker image *within* the CI/CD pipeline
2. Prebuilding the image

Let's see about option number (1).

1. Build the Docker image *within* the CI/CD pipeline

Luckily, a GitHub Action was already setup for us to do exactly this:

devcontainers/ci

To now build, push and run a command in the Devcontainer is as easy as:

```yaml

name: Python app

on:
  ...

jobs:
 build:
  runs-on: ubuntu-latest

  steps:
   - name: Checkout (GitHub)
    uses: actions/checkout@v3

   - name: Login to GitHub Container Registry
    uses: docker/login-action@v2
    with:
     registry: ghcr.io
```

To now build, push and run a command in the Devcontainer is as easy as:

```yaml
  steps:
    - name: Checkout (GitHub)
      uses: actions/checkout@v3

    - name: Login to GitHub Container Registry
      uses: docker/login-action@v2
      with:
        registry: ghcr.io
        username: ${{ github.repository_owner }}
        password: ${{ secrets.GITHUB_TOKEN }}

    - name: Build and run dev container task
      uses: devcontainers/ci@v0.2
      with:
        imageName: ghcr.io/${{ github.repository }}/devcontainer
        runCmd: pytest .
```

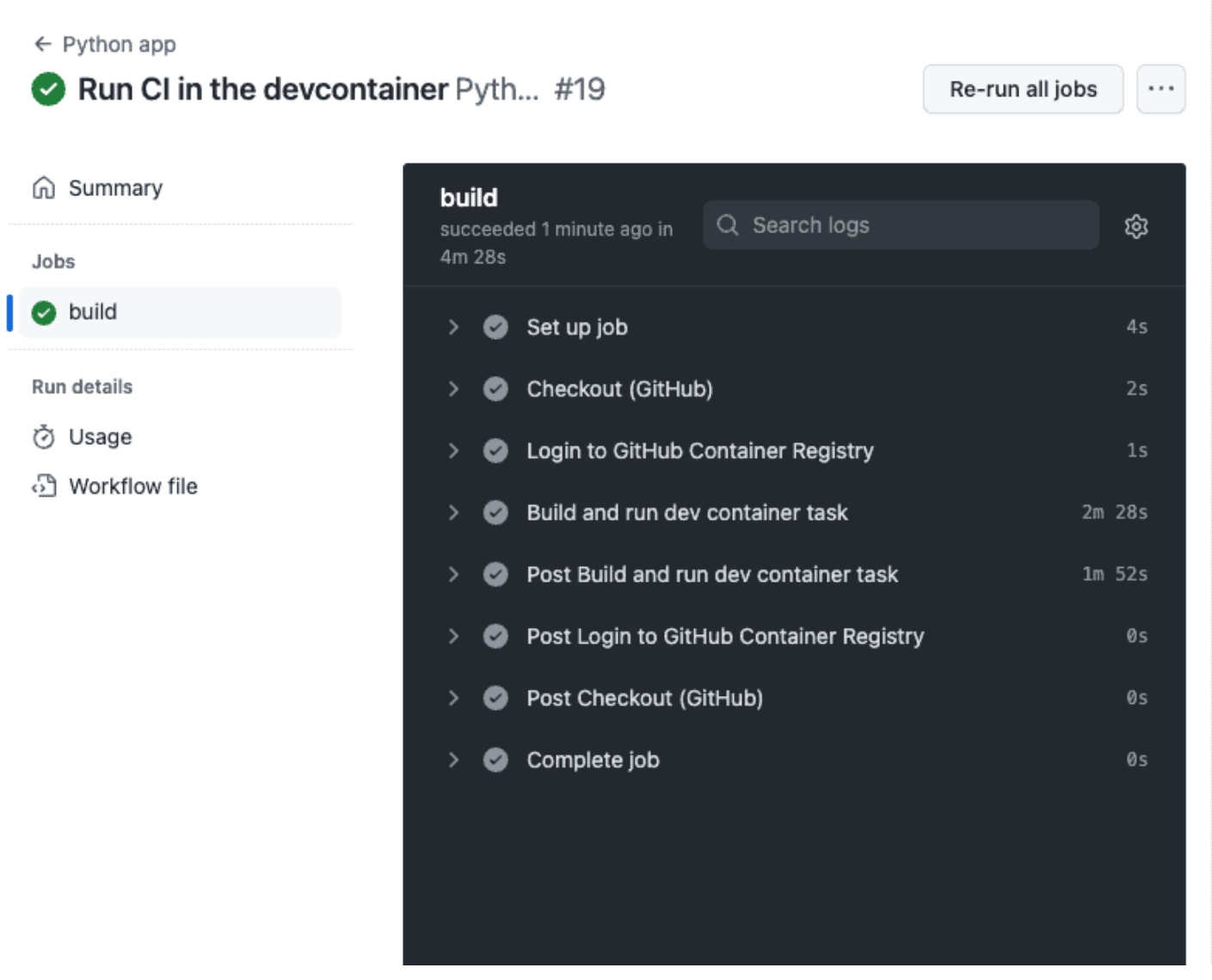
To now build, push and run a command in the Devcontainer is as easy as:

```yaml
  steps:
    - name: Checkout (GitHub)
      uses: actions/checkout@v3

    - name: Login to GitHub Container Registry
      uses: docker/login-action@v2
      with:
        registry: ghcr.io
        username: ${{ github.repository_owner }}
        password: ${{ secrets.GITHUB_TOKEN }}

    - name: Build and run dev container task
      uses: devcontainers/ci@v0.2
      with:
        imageName: ghcr.io/${{ github.repository }}/devcontainer
        runCmd: pytest .
```

See below a trace of the executed GitHub Action:



Awesome!

The final Devcontainer definition

We built the following Devcontainer definitions.

First, `devcontainer.json`:

```
{
    "build": {
        "dockerfile": "Dockerfile",
        "context": ".."
    },

    "remoteUser": "nonroot",

    "customizations": {
        "vscode": {
            "extensions": [
                "ms-python.python"
            ],
            "settings": {
                "python.testing.pytestArgs": [
                    "."
                ],
                "python.testing.unittestEnabled": false,
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                "python.linting.mypyEnabled": true,
                "python.linting.enabled": true
            }
        }
    },
    ...
}
```

```
"portsAttributes": {
    "4040": {
        "label": "SparkUI",
        "onAutoForward": "notify"
    }
},

"forwardPorts": [
    4040
]
```

And our `Dockerfile`:

```
FROM python:3.10

# Install Java
RUN apt update && \
    apt install -y sudo && \
    sudo apt install default-jdk -y

# Add non-root user
ARG USERNAME=nonroot
RUN groupadd --gid 1000 $USERNAME && \
    useradd --uid 1000 --gid 1000 -m $USERNAME
## Make sure to reflect new user in PATH
ENV PATH="/home/${USERNAME}/.local/bin:${PATH}"
USER $USERNAME

## Pip dependencies
# Upgrade pip
RUN pip install --upgrade pip
# Install production dependencies
COPY --chown=nonroot:1000 requirements.txt /tmp/requirements.txt
RUN pip install -r /tmp/requirements.txt && \
    rm /tmp/requirements.txt
# Install development dependencies
COPY --chown=nonroot:1000 requirements-dev.txt /tmp/requirements-
dev.txt
RUN pip install -r /tmp/requirements-dev.txt && \
    rm /tmp/requirements-dev.txt
```

Going further 🔮

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- Mounting directories

  💡 Pro tip: mount your AWS/GCP/Azure credentials

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  e.g. GitHub Codespaces, VM's on Azure/GCP/AWS

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- Devcontainer features

- **Remote Development** 🌐

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... and much more (see references slide)

Concluding

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🔌 **Devcontainers** connect your IDE to a running 🐳 Docker container.

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- ⏱️ Smaller gap to production

Now only VSCode, but open specification taking shape.

🤝

PP EO

BW PU JJ

🤝

PP EO

BW PU JJ

👊

Thanks! 🙌🏻

github.com/godatadriven/python-devcontainer-template

Awesome resources

Associated blog post:

- How to create a Devcontainer for your Python project 🐳

Spec:

- containers.dev. The official Devcontainer specification.
    - Devcontainer templates
    - Devcontainer features

Docs:

- Dev Containers VSCode extension. The extension required to connect VSCode to a Devcontainer.
- Mounting file directories in Devcontainers.
- Add a non-root user to a container. More explanations & instructions for adding a non-root user to your `Dockerfile` and `devcontainer.json`.
- Pre-building dev container images

Repo's:

- github.com/devcontainers/ci. Run your CI in your Devcontainers. Built on the Devcontainer CLI.
- github.com/devcontainers/images. A collection of ready-to-use Devcontainer images.
- github.com/manekinekko/awesome-devcontainers. A repo pointing to yet even more awesome resources.